MORPHOMETRIC AND MERISTIC ANALYSIS OF AMBLYCEPS MANGOIS (HAMILTON-BUCHANAN) FROM MANDAL RIVER GARHWAL HIMALAYA

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ABSTRACT

The research presented below deals with the work done on taxonomic analysis of a rare minor catfish-Amblyceps mangois, collected from river Mandal, a tributary of Ramganga in Garhwal Himalaya. For morphometric studies, the parameters considered were – the total length, standard length, head length, pre-dorsal length, pre-ventral length, pre-anal length, caudal length, snout length, eye diameter and maximum body depth. These (pre-dorsal length, pre-ventral length, pre-anal length, caudal length, snt. length, eye diameter and max. body diameter) variables were studied in relation to total length, standard length and head length separately as per taxonomic requirement. Meristic characters were also studied.

Keywords: Morphometric and Meristic Analysis and Amblyceps Mangois

I. INTRODUCTION

Taxonomy or the identification of fish is based on inter-relationships of morphometric, meristic and some descriptive characters. Speciation process depends on Intra specific variations which are due to the influencive environmental parameters (habitats, temperature, elevation, slope gradient, stream velocity, food, productivity, length, sex and age) or the difference in their genetic makeup. Day (1878), the first authority in fish taxonomy, described the taxonomy of various fishes of India, Burma, Pakistan and Ceylon in his book, *"*The fishes of India*"*, based on all these characters. According to Nikolski (1961), the species is characterized by relatively high morphobiological stability, the result of adaptation to particular environment within which it formed, developed and lived. Variability within the limits of the species does not exceed the boundaries of morphobiological specificity. The characteristics of a species represent and reflect its adaptation to a given set of environmental conditions. The species fills a particular niche, within the limits of which living conditions are adequate and in accordance with its morphobiological peculiarities. But the morphometric and meristic interrelationships of the species are not worked out in details yet. The present work will be significant in the taxonomic study of this genus. The importance of morphometric has also been proved in the study of sexual dimorphism. The identification of different sexes is important in sexwise selection of fish for induced breeding.

II. MATERIAL AND METHODS

Fishes were sampled monthly from different sections of river Mandal and were brought to the laboratory for further study. Morphometric measurements were taken in fresh condition and then the fish were preserved in 5 to 7% formaline solution. Fishes were tagged for further biological investigations.

III. MORPHOMETRIC STUDY

For morphometric studies, the parameters considered were the total length, standard length, head length, pre-dorsal length, pre-pelvic length (pre-ventral length), pre-anal length, caudal length, snout length, eye diameter and maximum body depth. These variables were studied in relation to total length, standard length and the head length separately as per taxonomic requirement. Fish measurement board and sharp pointed needle like dividers were used for taking body measurements.

IV. MERISTIC STUDY

The meristic characters like scale count and fin ray / spine count were made with the help of fine forceps and hand lens.

4.1 Regression Analysis

The original data were grouped into class intervals and the average values for the dependent (Y) and the independent variables (X) were calculated. These values then fed into an electronic calculator for computing the values of correlation coefficient (r) and regression coefficient (b) along with intercept (a). The relationships determined by fitting into the following straight-line equation:

$Y = a + b. X$

(Y= dependent variables, X = independent variables and “a” and “b” are the constants - intercept and the slope respectively). The linearity of the regression was tested by the analysis of variance (F Test).

V. OBSERVATIONS

For morphometric and meristic analysis, 82 specimens of *Amblyceps mangois* were used in different size groups. Body elongate, head small and broad depressed and covered with thick skin. Mouth wide, with 4 pairs of Barbels. The dorsal fin commences approximately midway between snout and the ventral fin. Caudal fin - truncate or imerginate. Eyes are small and dorso-laterally placed. As there was no any marked morphometric difference in male and female sexes, the detailed morphometric and meristic characters were studied in both the sexes together. Five size-groups were formed to interpret these characters. Morphometric characters are summarized in Table 2.1. The minimum sample size of 13 fish was considered in size group 5.1-6.0 cm and maximum (19) in the size group 7.1- 8.0 cm. Regression analysis of various body parameters with total length, standard length and head length were calculated and the statistical values of intercept (a), regression coefficient (b), coefficient of correlation (r) and coefficient of determination (r^2) are presented in Table 2.5, 2.6 and 2.7 respectively.

Statistics regarding how body parameters grow in ratio of total length is presented in Table 2.2. The ratio of total length and standard length fluctuated in between 1.26 ±0.04 : 1 in a size group of 4.1 to 5.0 cm to a maximum of 1.28 ±0.03 : 1 in the size group of 6.1 to 7.0 cm. Ratio of total length and head length fluctuated from 7.17

±0.07 in a length group of 5.1 to 6.0 cm to a maximum of 8.98 ±0.09 :1 in the length group of 7.1 to 8.0 cm. Ratio of total length to pre anal length was minimum 1.86 ±0.02 : 1 (4.0 to 5.0 cm) and maximum 2.13 ±0.02 : 1 (8.1 to 9.0 cm). Ratio of total length to pre dorsal length was minimum 4.41 ±0.06: 1 (5.1- 6.0 size groups) and maximum 4.93 ±0.09 (7.1 to 8.0). Ratio of total length to pre pelvic length was minimum 2.43 ± 0.05 : 1 (4.0-5.1 cm) and maximum 2.66 ±0.02 (6.1 to 7.1 cm). Ratio of total length to snout length was minimum 21.52 ± 0.16: 1 (5.1-6.0 cm) and maximum 27.57 ± 0.19 (8.1-9.0 cm). Ratio of total length to maximum body depth was minimum 7.08 ±0.01: 1 (5.1 to 6.0 cm) and maximum 7.88 ±0.02:1 (8.1-9.0 cm). The ratio of total length to eye diameter was minimum 41.35 ±0.19 (8.1-9.0 cm) and maximum 68.8±0.16:1 (6.1-7.0 cm). Ratio of total length to caudal length was minimum 4.41 ±0.12:1 (4.1-5.0 cm) and maximum 4.85 ±0.09 : 1 (4.1-5.0 cm).

Body parameters in ratio of standard length were calculated and presented in Table 2.3. The ratio of standard length and head length fluctuated from a minimum 5.67 ± 0.14 : 1 in a size group of 5.1 to 6.0 cm to a maximum of 7.07 ± 0.11: 1 in the size group of 7.1 to 8.0 cm. Ratio of standard length and pre anal length was minimum 1.48 ± 0.01 in a length group of 4.1 to 5.0 cm to a maximum of 1.68 ± 0.04 :1 in the length group of 8.1 to 9.0 cm. Ratio of standard length to pre dorsal length was minimum 3.48 ± 0.03: 1 (5.1 to 6.0 cm) and maximum 3.88 ± 0.06 : 1 (7.1 to 8.0). Ratio of Standard length to pre pelvic length was minimum 1.925 ± 0.01: 1 (4.1 to 5.0 cm) and maximum 2.07 ± 0.02 (8.1 to 9.0 cm). Ratio of Standard length to snout length was minimum 17.00 ± 0.36: 1 (5.1 to 6.0) and maximum 21.77 ± 0.09 (8.1 to 9.0). Ratio of standard length to maximum body depth was minimum 5.59 ± 0.1:1 (5.1 to 6.0) and maximum 6.22 ± 0.17 (8.1 to 9.0). Ratio of standard length to Eye diameter was minimum 32.65 ± 0.5: 1 (8.1 to 9.0 cm) and maximum 53.6 ± 0.35: 1 (6.1 to 7.0 cm). Ratio of standard length to Caudal length was minimum 3.48 ± 0.03: 1 (4.1 to 5.0 cm) and maximum 3.85 ± 0.2: 1 (4.1 to 5.0 cm).

Body parameters in ratio of head length were calculated and presented in Table 2.4. The ratio of head length to eye diameter fluctuated from minimum 4.75 ± 0.1:1 in a length group of 8.1 to 9.0 cm to a maximum of 7.7 ± 0.08: 1 in a length group of 6.1 to 7.0 cm. The ratio of head length to maximum body depth was minimum 0.85 ± 0.1: 1 (4.1-5.0 cm) and maximum 0.99 ± 0.1:1 (5.1 to 6.0 cm). The ratio of head length to snout length was minimum 2.57 ± 0.16: 1 (6.1 to 7.0) and maximum 3.17 ± 0.18: 1 (8.1 to 9.0 cm).

Data on modeling based on regression analysis is presented in the Tables 2.5 (Total length as independent parameter), 2.6 (Standard length as independent parameter) and 2.7 (Head length as independent parameter).

5.1 Different Models and Allied Statistical Parameters are as Follows

1. Standard length = 0.0445 + 0.7809 Total length
   Correlation coefficient (r) = 0.9995,
   Coefficient of determination (r^2) = 0.999
2. Caudal length = 0.0711 + 0.2036 Total length
   Correlation coefficient (r) = 0.988,
   Coefficient of determination (r^2) = 0.976
3. Pre-Dorsal length = 0.2488 + 0.1748 Total length
   Correlation coefficient (r) = 0.9845,
   Coefficient of determination (r^2) = 0.969
4. Pre-Pelvic Length = 0.3650 + 0.3328 Total length

Correlation coefficient (r) = 0.9969

Coefficient of determination (r^2) = 0.994

5. Pre-Anal Length = 0.5039 + 0.3642 Total length

Correlation coefficient (r) = 0.8009

Coefficient of determination (r^2) = 0.6407

6. Snout Length = 0. 0847 + 0.0281 Total length

Correlation coefficient (r) = 0.9065

Coefficient of determination (r^2) = 0.820

7. Eye Diameter = - 0.0304 + 0.0237 Total length

Correlation coefficient (r) = 0.7896

Coefficient of determination (r^2) = 0.622

8. Maximum Body depth = 0.1242 + 0.1126 Total length

Correlation coefficient (r) = 0.9907

Coefficient of determination (r^2) = 0.991

9. Head length = 0.1565 + 0.0935 Total length

Correlation coefficient (r) = 0.9179

Coefficient of determination (r^2) = 0.842

10. Caudal length = 0.0645 + 0.2598 Standard length

Correlation coefficient (r) = 0.9848

Coefficient of determination (r^2) = 0.9698

11. Pre Dorsal length = 0.2353 + 0.2245 Standard length

Correlation coefficient (r) = 0.9878

Coefficient of determination (r^2) = 0.9757

12. Pre-Pelvic length = 0.0389 + 0.1818 Standard length

Correlation coefficient (r) = 0.9666

Coefficient of determination (r^2) = 0.9343

13. Pre Anal length = 0.3428 + 0.4267 Standard length

Correlation coefficient (r) = 0.9987

Coefficient of determination (r^2) = 0.996

14. Snout length = 0.0853 + 0.0356 Standard length

Correlation coefficient (r) = 0.8960

Coefficient of determination (r^2) = 0.8028

15. Eye Diameter = - 0.0347 + 0.0309 Standard length

Correlation coefficient (r) = 0.8044

Coefficient of determination (r^2) = 0.647

16. Maximum Body depth = 0.1176 + 0.1442 Standard length

Correlation coefficient (r) = 0.9914

Coefficient of determination (r^2) = 0.982

17. Head Length = 0.1890 + 0.2234 Standard length

Correlation coefficient (r) = 0.9425

Coefficient of determination (r^2) = 0.887

18. Maximum Body depth = 0.0459 + 1.0622 Head length

Correlation coefficient (r) = 0.9513

Coefficient of determination (r^2) = 0.9049

19. Eye Diameter = - 0.0519 + 0.2304 Head length

Correlation coefficient (r) = 0.7797

Coefficient of determination (r^2) = 0.6079

20. Snout length = 0.0610 + 0.2706 Head length

Correlation coefficient (r) = 0.8878

Coefficient of determination (r^2) = 0.6913

Table 2.1: Summarized Data on the Morphometrics of A. Mangois (Ham-Buch)

S.No.	Size groups(cm)	TL	SL	CL	PDL	PVL	PAL	Snt.L	ED	MBD	HL	No. of fish
1	4.1-5.0	4.85± 0.05	3.85± 0.05	1.00± 0.00	1.10± 0.00	2.00± 0.00	2.60± 0.00	0.20± 0.00	0.10± 0.00	0.65± 0.05	0.55± 0.05	16
2	5.1-6.0	5.38± 0.26	4.25± 0.19	1.22± 0.10	1.22± 0.10	2.16± 0.15	2.72± 0.22	0.25± 0.05	0.10± 0.00	0.76± 0.06	0.75± 0.08	13
3	6.1-7.0	6.88± 0.08	5.36± 0.07	1.51± 0.03	1.40± 0.05	2.59± 0.15	3.34± 0.09	0.30± 0.00	0.10± 0.00	0.88± 0.08	0.77± 0.11	18
4	7.1-8.0	7.54± 0.29	5.94± 0.22	1.60± 0.09	1.53± 0.09	2.88± 0.16	3.70± 0.18	0.30± 0.00	0.13± 0.05	0.99± 0.08	0.84± 0.11	19
5	8.18.1-9.0 8.1-9.0	8.27± 0.17	6.53± 0.24	1.73± 0.07	1.75± 0.11	3.15± 0.11	3.88± 0.16	0.30± 0.00	0.20± 0.06	1.05± 0.11	0.95± 0.11	16

TL=Total length, SL=Standard length, HL=Head length, Snt.L=Snout length, MBD=Max.Body depth, PAL=Pre anal length, PDL=Pre dorsal length, PVL=Pre Ventral length, ED=Eye diameter, CL=Caudal length.

Table 2.2: Growth of Total Length in Ratio of Different Body Parts in Amblyceps Mangois

S. No.	Size groups (cm)	SL	CL	PDL	PVL	PAL	Snt.L	ED	MBD	HL
1	4.1-5.0	1.26 ±0.04	4.85 ±0.09	4.41 ±0.07	2.43 ±0.05	1.86 ±0.02	24.25 ±0.11	48.50 ±0.24	7.46 ±0.01	8.82 ±0.06
2	5.1-6.0	1.27 ±0.07	4.41 ±0.12	4.41 ±0.06	2.49 ±0.03	1.98 ±0.06	21.52 ±0.16	53.80 ±0.21	7.08 ±0.01	7.17 ±0.07
3	6.1-7.0	1.28 ±0.03	4.56 ±0.13	4.91 ±0.04	2.66 ±0.02	2.06 ±0.01	22.93 ±0.13	68.80 ±0.16	7.82 ±0.02	8.93 ±0.06
4	7.1-8.0	1.27 ±0.08	4.71 ±0.09	4.93 ±0.09	2.62 ±0.06	2.04 ±0.01	25.13 ±0.13	58.00 ±0.17	7.62 ±0.01	8.98 ±0.09
5	.0 8.1-9.0	1.27 ±0.06	4.78 ±0.11	4.72 ±0.07	2.62 ±0.02	2.13 ±0.02	27.57 ±0.19	41.35 ±0.19	7.88 ±0.02	8.70 ±0.1
Average		1.27± 0.01	4.66± 0.16	4.68± 0.23	2.56± 0.09	2.01± 0.09	24.28± 2.05	54.09±\ 9.22	7.57± 0.29	8.52± 0.68

Table 2.3: Growth of Standard Length in Ratio of Different Body Parts in A. Mangois

S. No.	Size groups (cm)	CL	PDL	PVL	PAL	Snt.L	ED	MBD	HL
1	4.1-5.0	3.85 ±0.02	3.50 ±0.04	1.925 ±0.01	1.48 ±0.01	19.25 ±0.24	38.50 ±0.25	5.92 ±0.2	7.00 ±0.12
2	5.1-6.0	3.48 ±0.03	3.48 ±0.03	1.97 ±0.01	1.56 ±0.02	17.00 ±0.36	42.50 ±0.26	5.59 ±0.1	5.67 ±0.14
3	6.1-7.0	3.55 ±0.02	3.83 ±0.04	2.07 ±0.01	1.60 ±0.01	17.87 ±0.19	53.6 ±0.36	6.09 ±0.11	6.96 ±0.16
4	7.1-8.0	3.71 ±0.01	3.88 ±0.06	2.06 ±0.02	1.60 ±0.02	19.80 ±0.16	45.69 ±0.49	6.00 ±0.12	7.07 ±0.11
5	8.1-9.0	3.77 ±0.04	3.73 ±0.07	2.07 ±0.02	1.68 ±0.04	21.77 ±0.09	32.65 ±0.5	6.22 ±0.17	6.87 ±0.13
6	Average	3.67± 0.14	3.67± 0.18	2.02± 0.06	1.58± 0.06	19.14± 1.65	42.59± 7.02	5.96± 0.21	6.71± 0.52

Table 2.4: Growth of Head Length in Ratio of Different Body Parts in A. Mangois

S.No	Size Group (cm)	MBD	Snt. L	ED
1	4.1-5.0	0.85 ±0.01	2.75 ±0.11	5.5 ±0.06
2	5.1-6.0	0.99 ±0.01	3.00 ±0.12	7.5 ±0.07
3	6.1-7.0	0.87 ±0.01	2.57 ±0.16	7.7 ±0.08
4	7.1-8.0	0.85 ±0.01	2.80 ±0.15	6.46 ±0.09
5	8.18.1-9.08.1- 8.1- 9.0	0.90 ±0.02	3.17 ±0.18	4.75 ±0.1

Table 2.5: Regression Analysis and Correlation Coefficient Between Total Length and Dependent Parameters

S.N.	Dependent parameter	Intercept "a"	Regression coefficient "b"	Correlation coefficient "r"	Coefficient Of Determination "r^2"
1	SL	0.0445	+0.7809	0.9995	0.999
2	CL	0.0711	+0.2036	0.9880	0.976
3	PDL	0.2488	+0.1748	0.9845	0.969
4	PVL	0.3650	+0.3328	0.9969	0.994

5	PAL	0.5039	+0.3642	0.8009	0.6407
6	Snt.L	0.0847	+0.0281	0.9065	0.820
7	ED	-0.0304	+0.0237	0.7896	0.622
8	MBD	0.1242	+0.1126	0.9907	0.981
9	HL	0.1565	+0.0935	0.9179	0.842

Table 2.6: Regression Analysis and Correlation Coefficient Between Standard Length and Dependent Parameters

S.N.	Dependent parameter	Intercept "a"	Regression coefficient "b"	Correlation coefficient "r"	Coefficient of Determination "r^2"
1	CL	0.0645	+0.2598	0.9848	0.9698
2	PDL	0.2353	+0.2245	0.9878	0.9757
3	PVL	0.0389	+0.1818	0.9666	0.9343
4	PAL	0.3428	+0.4267	0.9987	0.996
5	Snt.L	0.0853	+0.0356	0.8960	0.8028
6	ED	-0.0347	+0.0309	0.8044	0.647
7	MBD	0.1176	+0.1442	0.9914	0.982
8	HL	0.18903	+0.2234	0.9425	0.887

Table 2.7: Regression Analysis and Correlation Coefficient Between Head Length and Dependent Parameters in A.Mangois (Ham.-Buch.)

S.N.	Dependent parameter	Intercept "a"	Regression coefficient "b"	Correlation coefficient "r"	Coefficient of Determination "r^2"
1	MBD	0.0459	+1.0622	0.9513	0.9049
2	ED	-0.0519	+0.2304	0.7797	0.6079
3	Snt.L	0.0610	+0.2706	0.8878	0.6913

The significance of growth relationship between the independent and dependant morphometric characters was tested by analysis of variance (ANOVA). (Table 2.8, 2.9, 2.10).).Study indicated that in case of total length dependent parameters, the difference with standard length, Pre anal length was non significant but it was significant at 5 % level (table value- $F_{0.05}$ = 7.71) with caudal length ($F_{0.05}$ =15.431), pre dorsal length ($F_{0.05}$ =7.814), pre pelvic length ($F_{0.05}$ =8.74) and maximum body depth ($F_{0.05}$ = 19.315). However it was highly significant (table value- $F_{0.01}$ = 21.2) with snout length ($F_{0.01}$ = 23.899) and eye diameter ($F_{0.01}$ = 24.76).

In case of standard length dependent parameters, the difference with pre pelvic length, Pre anal length was non significant but it was significant at 5 % level (table value- $F_{0.05}$ = 7.71) with caudal length ($F_{0.05}$ =13.132), pre dorsal length ($F_{0.05}$ =13.47), Head length ($F_{0.05}$ = 18.857) and maximum body depth ($F_{0.05}$ =17.909). However it was highly significant (table value- $F_{0.01}$ = 21.2) with snout length ($F_{0.01}$ = 23.483) and eye diameter ($F_{0.01}$ = 25.1).

In case of head length dependent parameters, the difference with maximum body depth was non significant but it was significant at 5 % level (table value- $F_{0.05}$ = 7.71) with snout length ($F_{0.05}$ =13.888). Difference with eye diameter was significant at 1 % level ($F_{0.01}$ = 25.1). In present study it was observed that all the body parts grow in accordance with the total length of the body.

Table 2.8: Analysis of Variance (ANOVA) Between Total Length and Dependent Morphometric Characters in A.Mangois (Ham.-Buch.)

S.No.	Parameters	S^2B	S^2W	Observed F	Remarks
1	TL X SL	00.980	1.342	00.730	NS
2	TL X CL	13.364	0.866	15.431	*
3	TL X PDL	13.416	1.717	07.814	*
4	TL X PVL	08.080	0.924	08.744	*
5	TL X PAL	05.544	0.962	05.763	NS
6	TL X Snt.L	19.908	0.833	23.899	**
7	TL X ED	20.801	0.840	24.763	**
8	TL X MBD	16.302	0.844	19.315	*

Table 2.9: Analysis of Variance (ANOVA) Between Standard Length and Dependent Morphometric Characters in A.Mangois (Ham.-Buch.)

S.No.	Parameters	S^2B	S^2W	Observed F	Remarks
1	SL X CL	07.144	0.544	13.132	*
2	SL X PDL	07.220	0.536	13.470	*
3	SL X PVL	03.458	0.602	05.744	NS
4	SL X PAL	01.881	0.640	02.939	NS
5	SL X Snt.L	12.103	0.511	23.483	**
6	SL X ED	12.801	0.510	25.100	**
7	SL X MBD	09.331	0.521	17.909	*
8	SL X HL	09.768	0.518	18.857	*

Table 2.10: Analysis of Variance (ANOVA) Between Head Length and Dependent Morphometric Characters in A.Mangois (Ham.-Buch.)

S.No.	Parameters	S^2B	S^2W	Observed F	Remarks
1	HL X MBD	00.005	0.019	00.263	NS
2	HL X ED	00.205	0.009	22.778	**
3	HL X Snt.L	00.125	0.009	13.888	*

NS = insignificant, * = Significant at 5 % level ($F_{0.05}$ = 7.71; ndf=1, ddf=5);

** = Significant at 1 % level ($F_{0.01}$ = 21.2; ndf=1, ddf=5);

5.2 Meristic Analysis

On the basis of meristic analysis conducted on 82 specimen. The fin formula was summarized as follows:

D_1-I / 5-6, D_2-0, P- I /7, V-I / 5-6, A- II / 6-7, C-19, Barbels- 4 Pairs

VI. RESULT AND DISCUSSION

In the present study no any remarkable characters of sexual dimorphism were noticed in *Amblyceps mangois* except during breeding season when slight roughness on the belly of male fish was seen whereas there was smoothness on the belly of female. It is a temporary character which is seen especially during July-August, which was the breeding season of fish. Secondary sexual characters of many fishes are reported in earlier literature. According to Gunther (1886), in most teleost, the enlargement and coloration of the belly in adult female loaches is a characteristics feature during the breeding season. Hora (1922) identified sex distinguishing characters in male of *N. tibetanus* as a slit like deep groove in front of the eye and a kind of padding and thickening with tubercles on the upper surface of pectoral fins as found in most of the cyprinids. According to Banarescu and Nalbant (1968), in *N. rupelli*, males have a greater length of the head and a lesser depth of body and caudal peduncle. According to Pathani (1978), some males were brighter than the females and some males had small black spots on the lateral sides of mouth in *Tor tor*. According to Rita Kumari and Nair (1979), in *N. triangularis*, male, length of the head, caudal peduncle and height of head were found to be more than in the female whereas in the female, pre-dorsal, pre-pelvic length, pre-anal length, the length from tip snout to vent, height of caudal peduncle and depth and width of body were found to be more than in the male. Dobriyal et.al. (2007) reported sexual dimorphism in *P. conchonius.*

In present study it was observed that all the body parts grow in accordance with the total length of the body. Important highlights of the morphometric study are- (i) - The dorsal fin is situated almost midway between snout and pelvic fin. Apparently it is situated very close to pectoral fin. It is smooth and swollen, (ii) - Pre dorsal length (PDL) and caudal length (CL) is roughly similar (1.00 ± 0.0 to 1.75 ± 0.11), (iii)- Body is slightly deeper (0.65 ± 0.05 to 1.05 ± 0.11) than the head length (0.55 ± 0.05 to 0.95 ± 0.11), (iv)- In small size fish, the eye diameter (0.1 ± 0.0 constant) doesn't grow in accordance with snout length (0.2 ± 0.0 to 0.3 ±0.0) but in adult fish eye diameter grows (0.13 to 0.2) but snout length becomes constant (0.3 cm) and (v) - Spongy anal fin and second dorsal fin (adipose fin) occupy almost similar distance from snout tip and caudal fin tip. The maximum size reported in this study being 9.0 cm.

The meristic analysis of 82 specimens indicated that the dorsal fin in the meristic count was D_1-I / 5-6, D_2-0,, Pectoral fin P- 8 (1/7), Pelvic fin 6-7 (1/5-1/6), Anal fin 8-9 (2/6-2/7), Caudal fin-19 ,with 4 pairs of barbels. Slight difference was found in pelvic fin in which no spine is reported by Day (1878), However in present study 1 spine was recorded.

Lal (1967), while studing Rita rita from Varanasi and Mizzapur, observed no significant difference. Singh and Dobriyal (1983) studied the morphometric characters and their relationships in the hillstream cat fish Pseudecheneis sulcatus (McClelland) collected in the river Alaknanda at Srinagar and found no second stock. According to Dobriyal and Bahuguna (1987), there was no significant difference in the stock of population of N. montanus collected from Khanda stream. Dobriyal et al (1988) also reported single stock in Noemacheilus denisonii and Noemacheilus multifaciatus from the same stream. Uniyal et al (2005) also studied the morphometric characters and their relationship in the fish Tor chilinoides at Western Nayar and found no any second stock. Bahuguna (2007) concluded that there was a single stock of the population of Puntius conchonius (Ham-Buch) in Mandal river. Kar and Barbhuia (2010) worked extensively on morphometric and meristic characters of Chocolate mahseer Neolissochilus hexagonolepis and considered 26 morphometric characters.

REFERENCES

[1]. Bahuguna, P.K., Joshi, H.K., and Dobriyal, A.K. (2007). Single stock of Puntius conchonius (Pisces; Cyprinidae) from Garhwal Himalaya, Environmental conservation Journal 8(1-2).37-43

[2]. Banarescu, P. and Nalbant, T. (1968). Cobitidae (Pisces, Cypriniformes) collected by the German Indian Expedition. Mitt. Humburg. Zool. Mus. Inst. 65 : 327-351.

[3]. Banerjee, V. (1973). A biometric study of Puntius sophore (Ham.) Rate of growth of different body parameters. Proc. Nat. Acad. Sci. India. 43(2) : 41-44.

[4]. Chondar, S.L. (1974). Morphometric characters and their relationship in Gadusia chapra (Ham.). Proc. Indian Acad. Sci. 80B : 51-68.

[5]. Dobriyal, A.K. and Bahuguna, A.K. (1987). Morphometric character and their relationships in the hillstream loach Noemacheilus montanus. Him. J. Env. Zool 1 : 23-27..

[6]. Dobriyal, A.K., Bahuguna, A.K. and Singh, H.R. (1988). Morphometric characters and their relationship in two Noemacheilus species from Garhwal Himalaya. Agra. Boil. Res. 4(2) : 21-24.

[7]. Dobriyal, A.K., Bahuguna, P.K., Uniyal, S.P. and Joshi, H.K. (2007). Sexual

[8]. dimorphinism in the cyprinidae fish Puntius conchoniusi (Ham-Buch). J.Bombay. Nat. Hist. Soc. 104 (2): 225-226.

[9]. Gunther, A. (1886). Hand-buch deer Ichthyologie, Wien.

[10]. Hora, S.L. (1922). On fishes belonging to the family cobitidae from high altitudes in center Asia. Rec. Ind. Mus., 24 : 63-83. .

[11]. Kar and Barbhuia (2010) morphometric and meristic characters of Chocolate mahseer Neolissochilus hexagonolepis.

[12]. Lal, M.S. (1967). Studies on the fishery and biology of a freshwater teleost Rita rita. PhD thesis Agra University Agra.

[13]. Nikolsky, G.V. (1961).The causes of fluctuation in fish numbers.Vopr. Ikhtiol.1 : 4.

[14]. Pathani. S.S., and Das, S.M. (1978). Sexual dimorphism in Puntius conchonius (Ham). Science and Culture. 552.

[15]. Rita Kumari, S.D. and Nair, N.B. (1979). Sexual dimorphism in the loaches Noemacheilus. triangularis (Day) and Lepidocephalus thermalis (cuv. & vol.). J. Anim. Morph. Physiol. Vol 26 (1&2) :198-210.

[16]. Singh, H.R. and Dobriyal, A.K. (1983). Morphometric characters and their relationships in the catfish Pseudecheneis sulcatus. Indian J. Anim. Sci. 53 : 541-546.

[17]. Uniyal, S.P., Dobriyal, A.K., Bisht, M.S. and Joshi, H.K. (2005b). Morphometric and meristic analysis of Tor chelynoides (Pisces : cyprinidae) from the river Western Nayar of Garhwal, Central Himalaya. Panjab Univ Res. J. (Sci), Vol. 55 : 63-67.

[18]. Vishwanath, W. and Kosygin, L. (1999). A new sisorid catfish of the genus Myersglanis Hora and Silas 1951, From Manipur, India. J. Bombay. Nat. Hist. Soc. 96(2) : 291-296.